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(54) Junction component for connecting an electrical lead to a conductor of a printed circuit board

(57) The junction component fixed on a PCB (13) has a base part (11) and a connection part (12), the connection part (12) having a slot (4) suitable for accepting an electrical lead (10). The base part (11) is embedded into the PCB (13) and is connected with a conductor of the PCB. The electrical lead (10) is connected to the connection part (12). At the place of connection, the orientation of the electrical lead is substantially perpendicular to the plane of the PCB (13). The direction in which the electrical lead is moved to connect it to the connection part (12) is substantially parallel to the plane of the PCB (13) and the base part (11) comprises a base plate (1) with tab(s) (8a-8c) bending out from it. The tab or tabs protrude into openings (17) formed in the PCB (13). The connection part (12) has an orientation substantially in or parallel to the plane of the base plate (1).

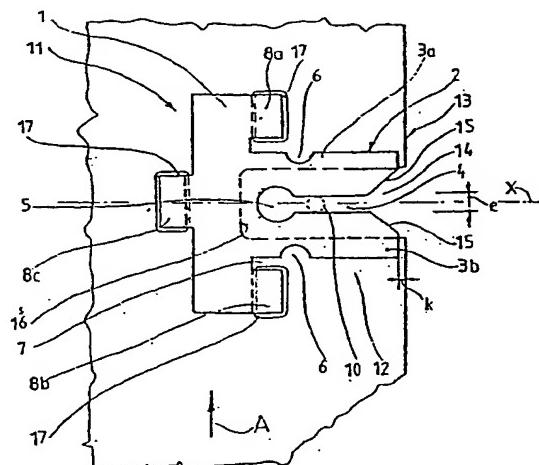


Fig. 1

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## Description

This invention relates to an electrically conducting junction component for connecting a conductor of a printed circuit board (hereinafter: PCB) to an electrical lead of a separate electrical unit. The junction component according to the invention may be used with advantage particularly in light sources, e.g. in discharge lamps including compact fluorescent lamps integral with an electronic ballast. The electrical unit in this case is represented by the discharge tube.

To assemble the discharge tubes integral with an electronic ballast, the electric conductors coming from the electrodes have to be connected with the terminals of the ballast, i.e. of the PCB. As it is known, one electrode is placed at each end of a discharge tube and the electric arc works between these electrodes. The electrical leads of the electrodes have to be connected with the electronic unit, i.e. with the corresponding terminals of the PCB. The task of the ballast is to start and to maintain the electric arc in the discharge tube. The electronic components necessary for operating the discharge tube or at least most of them are placed on the PCB in a way known in itself.

Earlier, the electrical connection was performed by aligning each electric conductor protruding from the discharge tube to the end of the corresponding lead protruding from the PCB, and pressing a piece of copper plate (copper ribbon) onto the ends of these connecting leads. The electrical connection was provided by these pressed sleeves. This solution, however, has disadvantages in several respects: to embed the connection leads into the PCB is a relatively complicated task; to perform the operation of pressing requires an additional equipment and is labor-consuming; finally, these leads have to be placed inside the shell belonging to the discharge tube which, in addition to the troublesome process, can cause various kinds of short circuit.

Recently, another solution has become known in which metal tubes with longitudinally slotted mantles are built in the PCB as electrical connection components. These tubes protrude from the board and the slots extend to the tube ends. The lead end protruding from the discharge tube is pressed into this slot, which results in the lead's getting stuck or jammed in the slot. Due to the damaged surface of the lead, the coating of oxide layer of the lead will be broken. In this way, an electrical connection comes into being which is maintained by the mechanical joint ensured by the jam (friction). Although the complicated operation of pressing the copper plate is not used in this solution, positioning the leads of the discharge tube to the corresponding slotted tubes cannot be avoided. This is caused by the off-positioned leads protruding from the discharge tube. These leads are not in line with the slotted tubes, therefore the discharge tube cannot be aligned with a PCB of fixed position. The slotted tubes can only be connected to the leads of the discharge tube if the PCB is placed outside the line of

the discharge tube. For this operation, the PCB must be positioned, which requires a separate machine. To make the electrical connection, the leads must be pressed into the slotted tubes being outside the position

needed for the mechanical connection. The slotted tubes are fixed to the PCB with soldering. This joint is rather sensitive and can easily be damaged as it is exposed to mechanical load during connecting the lead and the PCB to each other, a fact leading to the shortening of its life as a final result.

The objective of the invention was to provide a junction component for connecting a PCB and a separate electrical unit, which, when making the connection between these, does not expose the place of electrical connection on the PCB to mechanical load.

The invention is based on the recognition that the sensitive part of the junction component can be relieved of mechanical load by such a junction component which has a slot for accepting the electrical lead of the electrical unit and which is provided with component parts, e.g. tabs bent out from its own plate material, supported by the rim of the PCB so that the load appearing during inserting the lead into the slot acts on the said tabs.

Based on the above recognition, the objective set was, according to the invention, achieved by means of a junction component for connecting the electrical leads of a PCB and a separate electrical unit, which electrically conducting junction component is fixed on the PCB and has a slot suitable for accepting the leads protruding from the electrical unit. This junction component is composed of a base part and a connection part, of which the base part is embedded in the PCB and is connected with the corresponding output of the printed circuit, and the electrical leads of the electrical unit are connected to the connection part of the junction component with the orientation of the electrical leads being, where the connection is made, substantially perpendicular to the plane of the PCB. This junction component is characterized in that the direction in which the electrical lead is connected to the connection part is substantially parallel to the plane of the PCB, the base part is composed of a base plate and tab(s) bent out from it, which tab(s) protrudes (protrude) into hole(s) formed in the PCB, and is (are) embedded into it in a way providing electrical contact also with the PCB, the base plate joins the tab(s) with the connection part, and the connection part is formed so that its plane is substantially the same as or parallel to the plane of the base plate. Preferably, the connection part is placed at or adjacent to the edge of the PCB and the tab(s) passes (pass) through the PCB and is (are) fixed to it by means of soldering. In another embodiment, slots increasing the resilience of the connection part are formed in the base plate, adjacent to the connection part. According to another feature of the invention, the junction component has also a clamping arm that protrudes from the plane of its base plate.

The invention also relates to a junction component for connecting a PCB and a separate electrical unit

which electrically conducting junction component is fixed on the PCB and has a slot suitable for accepting the lead protruding from the electrical unit. This junction component consists of a base part and a connection part, of which the base part is embedded in the PCB and is connected with the corresponding output of the printed circuit, and the electrical leads of the electrical unit are connected to the connection part with the orientation of the electrical leads being, where the connection is made, substantially perpendicular to the plane of the PCB. This junction component is characterized in that the connection part is represented by a clamping fork having resilient prongs, and protruding from the base plate of the base part and the prongs of the clamping fork are placed in substantially parallel direction to the PCB, and a slot is provided between them for accepting an electrical lead the direction of which is substantially perpendicular to the PCB. It is advantageous when the clamping fork protrudes beyond the PCB at its edge and a cutout is provided in the PCB around the slot of the clamping fork. According to a further feature of the invention, the end portion of the slot for introducing the electric lead is formed as an outwardly broadening space bordered by slant guiding surfaces. The inner end of the slot can preferably continue in a broadening hole. In another embodiment, notches narrowing the prongs of the clamping fork and increasing resilience are made on the outer side of the prongs of the clamping fork, adjacent to the base plate.

In what follows, the invention will be described in detail based on the attached drawings illustrating preferred embodiments of the junction component and some possible ways of its connection with a PCB. In the drawings:

- Fig. 1 shows an embodiment of the junction component according to the invention where the junction component is built into the PCB; this embodiment is shown in a view perpendicular to the plane of the PCB.
- Fig. 2 is the view from the arrow A indicated in Fig. 1;
- Fig. 3 is an exploded view where a junction component of the construction shown in Figure 1 is illustrated in perspective, built in a position to fit to one of the edges of the PCB;
- In Fig. 4, another embodiment of the junction component according to the invention is shown also in perspective.

The junction component shown in Figs. 1 and 2, which may be made by means of slitting and cutting operations, has a base part 11 and a connection part 12. The material of the junction component is a metal plate. The base part 11 is in connection with PCB 13 shown partly in Figs. 1 and 2, and the connection part 12 is in

connection with an electrical lead 10 being a part of an electrical unit, e.g. a discharge tube (not shown). The end portion of the electrical lead 10 intended to make electrical connection is shown as dashed lines in Figs. 5 and 2.

In the case of this embodiment, the connection part 12 has a clamping fork 2 which protrudes from and is in the plane of the rectangular base plate 1 of base part 11 and is also perpendicular to the longer side of the rectangle. A slot 4 is placed between the prongs 3a, 3b of the said clamping fork 2 (Fig. 1). The width e of slot 4 is preferably smaller than the diameter d of the lead 10, and the slot 4 broadens in the region of its outside end. The space 14 having increasing width outwards is bordered by the inner slant guiding surfaces 15 of the prongs 3a, 3b (Fig. 1). The inner end of the slot 4 leads into hole 5. Semicircular-shaped notches 6 are placed on the outer side of the prongs 3a, 3b, adjacent to the base plate 1. Starting from these notches 6, slits 7 are placed which increase the resilience of the connection part 12 and protrude into the base plate 1 and are perpendicular to its longitudinal direction. These slits 7 together with the said hole 5 make it easier for the prongs 3a, 3b of the clamping fork 2 to move apart from each other to a small extent, i.e. to be deformed resiliently, when the lead 10 is pushed into the slot 4 during connecting. Notches 6 play a role primarily in the assembling and manufacturing process.

Tabs 8a, 8b and 8c of the same height m (Fig. 2) starting and bent out in the same direction from and perpendicular to the plane of the base plate 1 of the base part 11 belong to the base part 11. The tabs 8a and 8b are placed at the opposite sides of the clamping fork 2 at the outer sides of said slits 7. The tab 8c is placed in line with the clamping fork 2 but on that side of the base plate 1 which is opposite to the clamping fork 2. As seen in Fig. 1, the junction component is symmetrical to the geometrical center plane X which is perpendicular to the base plate 1 and passes through the slot 4 and is denoted by a dash-dot line. The height m depends on the thickness of the sheet material of the junction component, and it should also fit to the sheet thickness f of the PCB 13 (Fig. 2). This is necessary because the junction component is fixed to the PCB 13 by the tabs 8a, 8b and 8c of the base part 11. Each of the tabs 8a, 8b, 8c being parallel to each other is passed through a through opening 17 formed in the PCB 13, and the ends of the tabs slightly protruding from the PCB 13 are fixed to the PCB 13 by solder 13a. In case of the example according to Figs. 1 and 2, the junction component is countersunk into the PCB 13 in the way that the connection part 12 does not protrude in lateral direction from the PCB 13. However, it is placed above an elongated opening 16 indented into PCB 13 in a lateral direction. The edge of the PCB 13 protrudes beyond the end of the clamping fork 2 of connection part 12 slightly, amounting to a spacing k. The construction described results in that when the PCB 13 and the lead 10 of a separate electrical

unit, e.g. of a discharge tube (not shown) are pushed together during assembly, the tabs 8a-8c are exposed to the mechanical loads caused by this assembling operation, and these tabs 8a-8c are able to take up these loads safely, thereby relieving the electrical connector components of mechanical loads.

The embodiment of the junction component seen in Fig. 3 corresponds to that according to Figs. 1 and 2, therefore the reference numbers of these latter ones are used to denote the identical construction parts. The solution seen in Fig. 3 differs from that illustrated in Figs. 1 and 2 in that the junction component is not countersunk into the PCB 13, but the clamping fork 2 of the connection part 12 protrudes outwards from the edge of the PCB 13. The base plate 1 of the base part 11 and the clamping fork 2 of the connection part 12 are parallel to the plane of the PCB 13 in this case as well. Here, connection of the base part 11 to the PCB 13 is made in the way that only the tab 8c is passed through and fixed to the PCB 13 (the opening for this and the solder on the other side of the PCB 13 are not shown in Fig. 3 for better overview), while the tabs 8a and 8b fit to the edge of the PCB 13. The mechanical loads occurring when the lead 10 is inserted into the slot 4 of the clamping fork 2 are taken up by the tabs 8a-8c in this case as well.

The embodiment of the junction component seen in Fig. 4 differs from those according to Figs. 1 through 3 as follows: it has only two tabs 8a, 8b perpendicular to the base plate 1 of the base part 11, which tabs 8a, 8b protrude from this base plate 1 in one direction and are placed at a spacing  $h$  one below or above the other. Also, an arm 9 protrudes in the direction opposite to the tabs 8a, 8b, which arm 9 is provided for the purposes of the manufacturing process: controlled by the manufacturing program, the junction component is gripped, moved and embedded into the PCB 13 by an automatic equipment (not shown). In Fig. 4, the PCB is not shown and construction components described previously are denoted by the reference numbers already used. Connection of the junction component according to Fig. 4 to the PCB is made in a way similar to that according to Figs. 1 and 2, i.e. this is a countersunk construction, which means that the end of the clamping fork 2 of the connection part 12 will be, in top view, inside of the edge of the PCB. It is a difference from the solution shown in Figs. 1 and 2 that only two tabs 8a, 8b are passed through and soldered to the PCB.

It is an advantage of fundamental importance that the junction component relieves the sensitive and delicate electrical contact points on the PCB of the mechanical loads occurring during the assembly of the PCB with a separate electrical unit, e.g. in manufacturing light sources, such as compact fluorescent lamps, integral with an electronic ballast. This results in the lengthening of lifetime of the product.

A further advantage is that by using the junction component according to the invention the operation of making the electrical contact will be significantly simpli-

fied: soldering the leads of the electrical unit or a more complicated contact making is not needed. The operation for making a mechanical (snap-in) joint will automatically ensure that the electrical connection is performed.

- 5 Assembling can be well automated. The junction component is small-sized, thus requires small room and can be used for operating units of practically any shape, position, number and size. The same junction component can be used for PCBs of different shape, number and
- 10 position. The electrical connection is of excellent safety (the force needed to maintain the contact is provided by resilient deformation and the direction of electric lead is perpendicular to the printed-circuit board), in addition the possibility to collide with certain mounts will be reduced.

### Claims

- 20 1. Junction component for connecting an electrical lead (10) to a conductor of a printed circuit board (13), the junction component comprising a base part (11) and a connection part (12), of which the base part is secured to the printed circuit board and is connected with the conductor of the printed circuit, and the connection part including a slot (4) for accepting an electrical lead with the orientation of the electrical lead being, where the connection is made, substantially perpendicular to the plane of the printed circuit board, the direction in which the electrical lead is moved to connect it to the connection part (12), being substantially parallel to the plane of the printed circuit board (13), and the base part (11) comprising a base plate (1) with one or more tabs (8a,8b,8c) bent out from it which tab or tabs (8a,8b,8c) protrude into one or more holes formed in the printed circuit board (13), the connection part (12) being formed so that its plane is substantially the same as or parallel to the plane of the base plate (1).
- 25 2. Junction component according to claim 1 wherein the connection part (12) is placed at the edge or close to the edge of the printed circuit board (13).
- 30 3. Junction component according to claim 1 or claim 2 wherein the tab(s) (8a,8b,8c) is (are) passed through the printed circuit board (13) and is (are) fixed to it by means of soldering.
- 35 4. Junction component according to any one of claims 1 to 3, wherein slits (7) are formed in the base plate (1), close to the connection (12), for increasing the resilience of connection part (12).
- 40 5. Junction component according to any one of claims 1 to 4, wherein it also comprises an arm (9) for gripping that protrudes from the plane of the base plate

(1) in a direction opposite to the tab(s).

6. Junction component according to any one of claims 1 to 5, wherein the connection part (12) comprises a clamping fork (2) having resilient prongs (3a,3b) protruding from the base plate (1) of the base part (11), the prongs (3a,3b) being substantially parallel to the printed circuit board (13), and between them a slot (4) being provided for accepting an electrical lead (10), the direction of which is substantially perpendicular to the printed circuit board (13). 5
7. Junction component for connecting an electrical lead (10) to a conductor of a printed circuit board (13), the junction component comprising a base part (11) and a connection part (12), of which the base part is secured to the printed circuit board and is connected with the conductor of the printed circuit, and the connection part including a slot (4) for accepting an electrical lead with the orientation of the electrical lead being, where the connection is made, substantially perpendicular to the plane of the printed circuit board, wherein the connection part (12) comprises a clamping fork (2) having resilient prongs (3a,3b) protruding from the base plate (1) of the base part (11), the prongs (3a,3b) being substantially parallel to the printed circuit board (13), and between them a slot (4) being provided for accepting an electrical lead (10), the direction of which is substantially perpendicular to the printed circuit board (13). 10 15 20 25
8. Junction component according to claim 7, wherein the clamping fork (2) protrudes beyond the printed circuit board (13) at its edge. 30 35
9. Junction component according to claim 7, wherein on the printed circuit board (13) an opening (16) is formed around the slot (4) of the clamping fork. 40
10. An electric lamp assembly comprising a lamp having at least one electrical lead protruding therefrom, and a printed circuit board having electrical circuitry thereon, the electrical lead of the lamp being connected to a conductor of the printed circuit board by a junction component according to any one of claims 1 to 9. 45

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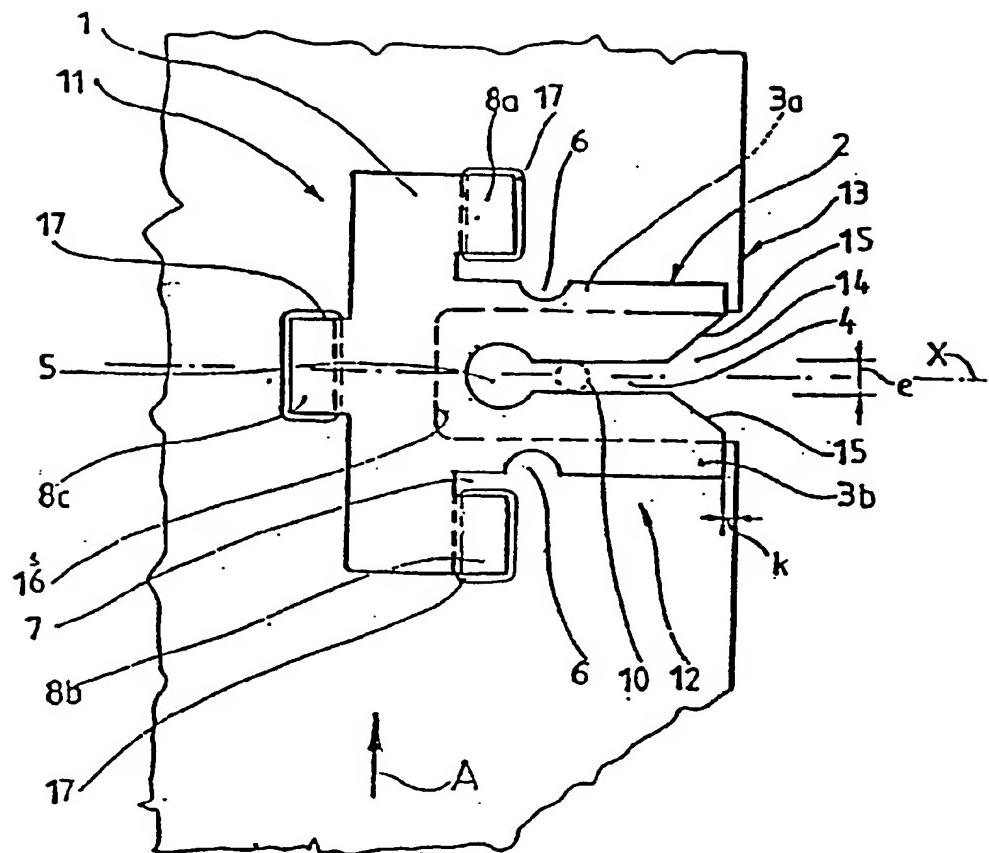


Fig. 1

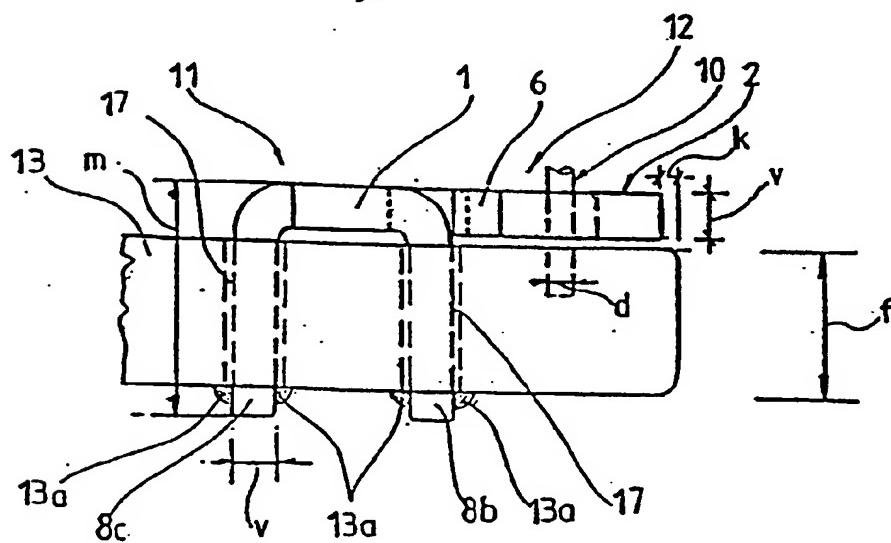


Fig. 2

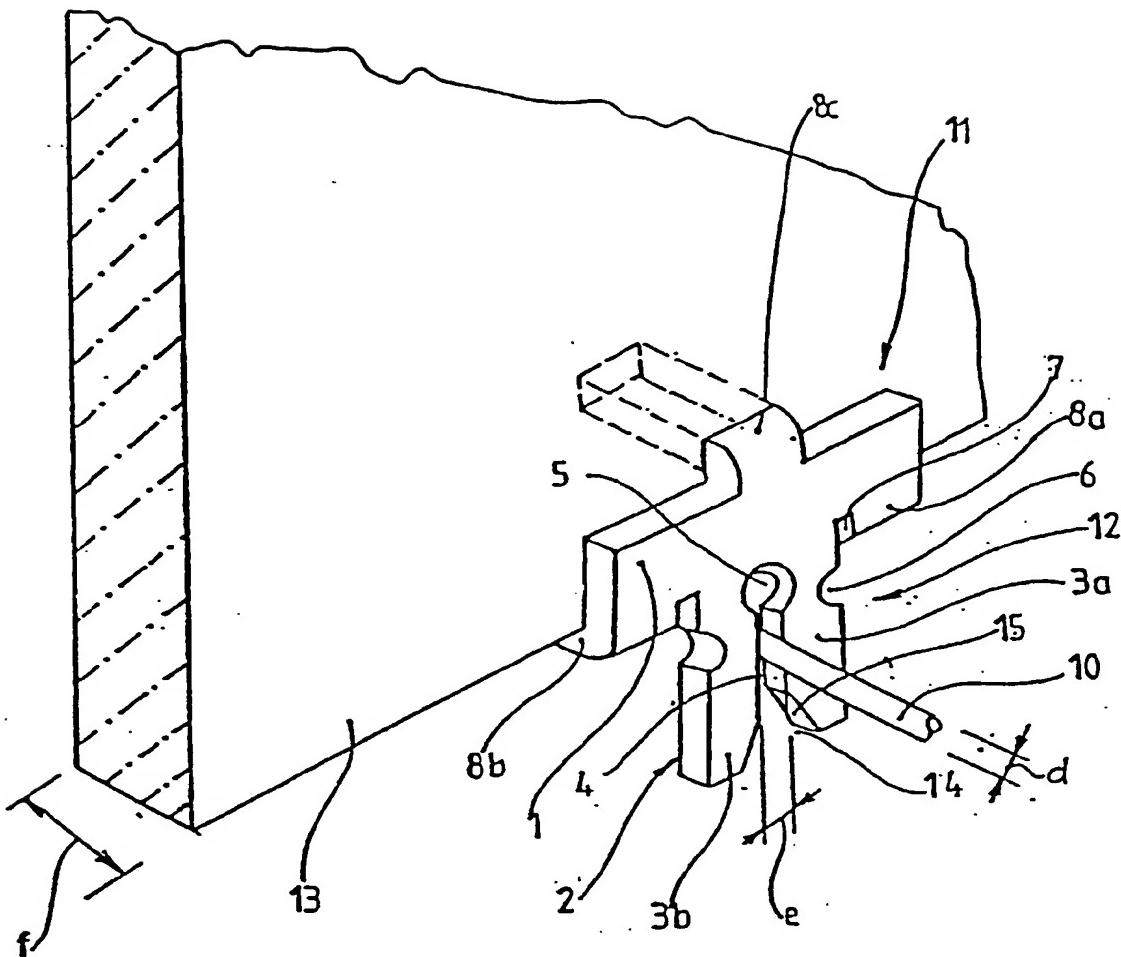


Fig. 3.

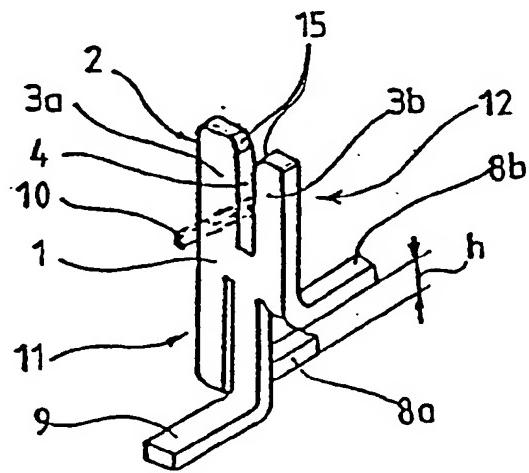


Fig. 4



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## EUROPEAN SEARCH REPORT

Application Number  
EP 96 30 3523

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP-A-0 312 846 (SIEMENS AG) 26 April 1989 * abstract; figure 1 * ---	1,4,6,7	H01R9/09 H01R4/24 H01R13/415
X	US-A-4 909 754 (PARADIS ROGER L.) 20 March 1990 * abstract; figure 4 * ---	1,4,6,7	
X	US-A-4 836 792 (GLOVER, ALFRED H.) 6 June 1989	1	
A	* column 2, line 24-51; figures 3-5 *	2-10	
A	US-A-2 209 734 (LARKIN, WILLIAM) 30 July 1940 * column 2, line 6 - column 3, line 43; figures 4,9,11 *	1-10	
A	US-A-3 147 060 (JENSEN W.T.) 1 September 1964 * column 2, line 28-78; figure 3 *	1-10	
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TECHNICAL FIELDS SEARCHED (Int.Cl.6)			
H01R			
The present search report has been drawn up for all claims			
Place of search  THE HAGUE	Date of completion of the search  20 August 1996	Examiner  Waern, G	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	
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